



US009839740B2

(12) **United States Patent**  
**Beamer et al.**

(10) **Patent No.:** **US 9,839,740 B2**  
(45) **Date of Patent:** **Dec. 12, 2017**

(54) **INTRAOSEOUS-NEEDLE STABILIZER AND METHODS**

(75) Inventors: **Cynthia L. Beamer**, Helotes, TX (US);  
**Chris Kilcoin**, South Lake Tahoe, CA (US)

(73) Assignee: **TELEFLEX MEDICAL DEVICES S.À R.L.**, Luxembourg (LU)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1004 days.

(21) Appl. No.: **13/576,943**

(22) PCT Filed: **Feb. 2, 2011**

(86) PCT No.: **PCT/US2011/023496**

§ 371 (c)(1),  
(2), (4) Date: **Dec. 24, 2012**

(87) PCT Pub. No.: **WO2011/097311**

PCT Pub. Date: **Aug. 11, 2011**

(65) **Prior Publication Data**

US 2013/0096508 A1 Apr. 18, 2013

**Related U.S. Application Data**

(60) Provisional application No. 61/184,035, filed on Feb. 2, 2010.

(51) **Int. Cl.**

**A61M 5/32** (2006.01)

**A61M 5/00** (2006.01)

(Continued)

(52) **U.S. Cl.**

CPC ..... **A61M 5/00** (2013.01); **A61B 17/3472** (2013.01); **A61M 5/158** (2013.01);

(Continued)

(58) **Field of Classification Search**

CPC ..... **A61B 17/3472**; **A61B 2017/3492**; **A61B 5/6878**; **A61B 10/025**; **A61B 2018/00565**;

(Continued)

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

2,001,638 A 5/1935 Tornsjo ..... 128/347  
2,317,648 A 4/1943 Sigveland ..... 32/26

(Continued)

**FOREIGN PATENT DOCUMENTS**

CA 2138842 6/1996  
CA 2454600 1/2004

(Continued)

**OTHER PUBLICATIONS**

“Proven reliability for quality bone marrow samples”, Special Procedures, Cardinal Health, 6 pages, 2003.

(Continued)

*Primary Examiner* — Kevin C Sirmons

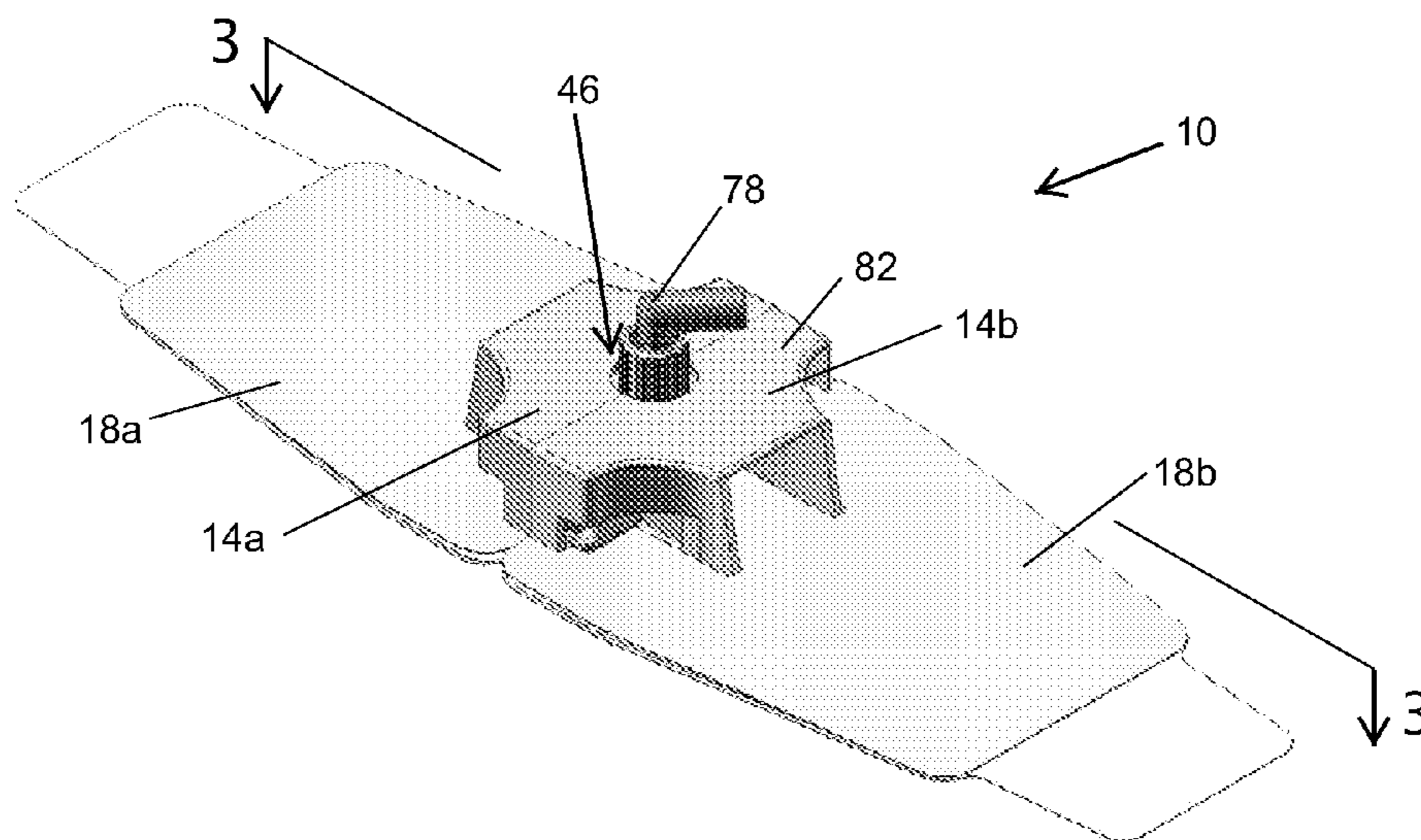
*Assistant Examiner* — Leah Swanson

(74) *Attorney, Agent, or Firm* — Baker & Hostetler LLP

(57) **ABSTRACT**

Stabilizers for intrasosseous devices, such as, for example, stabilizers that may be coupled to an intrasosseous device (e.g., a device including an intrasosseous needle) while a portion of the device extends into a patient’s bone and/or while the device is coupled to a fluid source (e.g., FV bag, syringe, etc.).

**22 Claims, 4 Drawing Sheets**



- (51) **Int. Cl.**  
*A61B 17/34* (2006.01)  
*A61M 5/158* (2006.01)
- (52) **U.S. Cl.**  
 CPC ..... *A61B 2017/3492* (2013.01); *A61M 2005/1585* (2013.01); *A61M 2210/02* (2013.01)
- (58) **Field of Classification Search**  
 CPC ..... *A61B 2017/348*; *A61M 5/158*; *A61M 2005/1581*; *A61M 2005/1585*; *A61M 2005/1586*; *A61M 25/02*; *A61M 2210/02*; *A61M 2039/025*; *A61M 2202/10*  
 USPC ..... 604/174, 177, 179, 180  
 See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,815,605	A	6/1974	Schmidt et al.	128/305
3,991,765	A	11/1976	Cohen	128/305
4,142,517	A	3/1979	Stavropoulos	128/2 B
4,170,993	A	10/1979	Alvarez	128/214 R
4,646,731	A	3/1987	Brower	128/156
4,659,329	A	4/1987	Annis	604/180
4,758,225	A	7/1988	Cox et al.	604/126
4,772,261	A	9/1988	Von Hoff et al.	604/51
4,969,870	A	11/1990	Kramer et al.	604/51
5,057,085	A	10/1991	Kopans	604/173
5,116,324	A	5/1992	Brierley et al.	604/180
5,120,312	A	6/1992	Wigness et al.	604/175
5,122,114	A	6/1992	Miller et al.	604/49
5,195,985	A	3/1993	Hall	604/195
5,203,056	A	4/1993	Funk et al.	24/543
5,312,364	A	5/1994	Jacobs	604/180
5,332,398	A	7/1994	Miller et al.	604/175
5,372,583	A	12/1994	Roberts et al.	604/51
5,385,553	A	1/1995	Hart et al.	604/167
5,423,824	A	6/1995	Akerfeldt et al.	606/80
5,431,655	A	7/1995	Melker et al.	606/79
5,451,210	A	9/1995	Kramer et al.	604/137
5,484,442	A	1/1996	Melker et al.	606/79
5,591,188	A	1/1997	Waisman	606/182
5,601,559	A	2/1997	Melker et al.	606/79
5,733,262	A	3/1998	Paul	604/116
5,769,086	A	6/1998	Ritchart et al.	128/753
5,779,708	A	7/1998	Wu	606/80
5,858,005	A	1/1999	Krisel	604/180
5,868,711	A	2/1999	Kramer et al.	604/136
5,960,797	A	10/1999	Kramer et al.	128/899
6,018,094	A	1/2000	Fox	623/11
6,228,088	B1	5/2001	Miller et al.	606/80
7,008,383	B1	3/2006	Damadian et al.	600/567
7,137,985	B2	11/2006	Jahng	606/61
7,207,949	B2	4/2007	Miles	600/554
7,615,043	B2	11/2009	Zhou	604/523
7,670,328	B2	3/2010	Miller	604/506
7,699,850	B2	4/2010	Miller	606/80
7,811,260	B2	10/2010	Miller et al.	604/188
7,815,642	B2	10/2010	Miller	606/79
7,850,620	B2	12/2010	Miller et al.	600/568
7,899,528	B2	3/2011	Miller et al.	607/3
7,951,089	B2	5/2011	Miller	600/566
8,038,664	B2	10/2011	Miller et al.	604/506
8,217,561	B2	7/2012	Fukuzawa	313/141
8,308,693	B2	11/2012	Miller et al.	604/188
8,419,683	B2	4/2013	Miller et al.	604/117
8,480,632	B2	7/2013	Miller et al.	604/188
8,506,568	B2	8/2013	Miller	606/80
8,641,715	B2	2/2014	Miller	606/80
8,656,929	B2	2/2014	Miller et al.	128/898
8,668,698	B2	3/2014	Miller et al.	606/80
8,684,978	B2	4/2014	Miller et al.	604/235
8,690,791	B2	4/2014	Miller	600/562
8,715,287	B2	5/2014	Miller	606/80
8,812,101	B2	8/2014	Miller et al.	607/3

2003/0225344	A1	12/2003	Miller	600/568
2003/0225411	A1	12/2003	Miller	606/80
2004/0064136	A1	4/2004	Papineau et al.	606/41
2004/0220497	A1	11/2004	Findlay et al.	600/562
2005/0027210	A1	2/2005	Miller	600/567
2005/0038453	A1*	2/2005	Raulerson	606/151
2005/0040060	A1	2/2005	Andersen et al.	206/363
2005/0131345	A1	6/2005	Miller	604/117
2005/0148940	A1	7/2005	Miller	604/187
2005/0165403	A1	7/2005	Miller	606/79
2005/0165404	A1	7/2005	Miller	606/80
2005/0171504	A1	8/2005	Miller	604/506
2005/0182420	A1	8/2005	Schulte et al.	606/130
2005/0228309	A1	10/2005	Fisher et al.	600/562
2005/0261693	A1	11/2005	Miller et al.	606/80
2006/0030825	A1*	2/2006	Enns	A61M 5/158 604/264
2006/0036212	A1	2/2006	Miller	604/48
2006/0052790	A1	3/2006	Miller	606/80
2006/0167378	A1	7/2006	Miller	600/566
2006/0167379	A1	7/2006	Miller	600/566
2006/0184063	A1	8/2006	Miller	600/568
2006/0247577	A1*	11/2006	Wright	604/174
2007/0016100	A1	1/2007	Miller	600/567
2007/0049945	A1	3/2007	Miller	606/86
2007/0149920	A1	6/2007	Michels et al.	604/93.01
2008/0045861	A1	2/2008	Miller et al.	600/567
2008/0045965	A1	2/2008	Miller et al.	606/80
2008/0140014	A1	6/2008	Miller et al.	604/180
2008/0215056	A1	9/2008	Miller et al.	606/80
2008/0221580	A1	9/2008	Miller et al.	606/80
2010/0004626	A1	1/2010	Miller et al.	604/506

FOREIGN PATENT DOCUMENTS

EP	0984809	3/2005
FR	2457105	12/1980
WO	WO 02/096497	12/2002
WO	WO 2005/112800	12/2005
WO	WO 2008/081438	7/2008

OTHER PUBLICATIONS

“Vidacare Comments on Infusion Nurses Society Position Paper on Intraosseous Vascular Access,” May 4, 2009.

Astrom, K. Gunnar O., “CT-guided Transsternal Core Biopsy of Anterior Mediastinal Masses,” *Radiology* 1996; 199:564-567.

Astrom, K.G., “Automatic Biopsy Instruments Used Through a Coaxial Bone Biopsy System with an Eccentric Drill Tip,” *Acta Radiologica*, 1995; 36:237-242.

BioAccess.com, Single Use Small Bone Power Tool—How It Works, 1 pg. Jun. 9, 2008.

Buckley et al., CT-guided bone biopsy: Initial experience with commercially available hand held Black and Decker drill, *European Journal of Radiology* 61, pp. 176-180, 2007.

Cummins, Richard O., et al, “Acls-Principles and Practice”, *ACLS—The Reference Textbook*, American Heart Association, pp. 214-218, 2003.

F.A.S.T. I Intraosseous Infusion System with Depth-Control Mechanism Brochure, 6 pages, 2000.

Gunal et al., Compartment Syndrome After Intraosseous Infusion: An Experimental Study in Dogs, *Journal of Pediatric Surgery*. 31 (11):1491-1493, 1996.

Hakan et al., CT-guided Bone Biopsy Performed by Means of Coaxial Bopsy System with an Eccentric Drill, *Radiology*, pp. 549-552, 1993.

International Preliminary Report on Patentability in PCT Application No. PCT/US2011/023496, dated Aug. 16, 2012.

International Search Report and Written Opinion issued in PCT Application No. PCT/US2011/023496, dated Oct. 24, 2011.

International Search Report and Written Opinion issued in PCT Application No. PCT/US2007/072217 dated Mar. 31, 2008.

International Search Report and Written Opinion issued in PCT Application No. PCT/US2007/072209 dated Apr. 25, 2008.

(56)

**References Cited**

OTHER PUBLICATIONS

Liakat A. Parapia, Trepanning or trephines: a history of bone marrow biopsy, *British Journal of Haematology*, pp. 14-19, 2007.

Michael Trotty, "Technology (A Special Report)—The Wall Street Journal 2008 Technology Innovation Awards—This years winners include: an IV alternative, a better way to make solar panels, a cheap, fuel efficient car and a better way to see in the dark", *The Wall Street Journal, Factiva*, 5 pages, 2008.

Office Communication in European Application No. 03756317.8 dated Dec. 28, 2006.

Office Communication issued in Chinese Patent Application No. 200780000585.5, dated Feb. 29, 2012.

Office Communication issued in Chinese Patent Application No. 200780000585.5, dated Nov. 19, 2010.

Office Communication issued in Taiwanese Patent Application No. 096140082, dated Mar. 27, 2013.

*Pediatrics*, Official Journal of the American Academy of Pediatrics, Pediatrics, 2005 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care of Pediatric and Neonatal Patients: Pediatric Advanced Life Support, Downloaded from [www.pediatrics.org](http://www.pediatrics.org), Feb. 21, 2007.

Riley et al., "A Pathologist's Perspective on Bone Marrow Aspiration Biopsy: I. Performing a Bone Marrow Examination," *Journal of Clinical Laboratory Analysis* 18, pp. 70-90, 2004.

\* cited by examiner

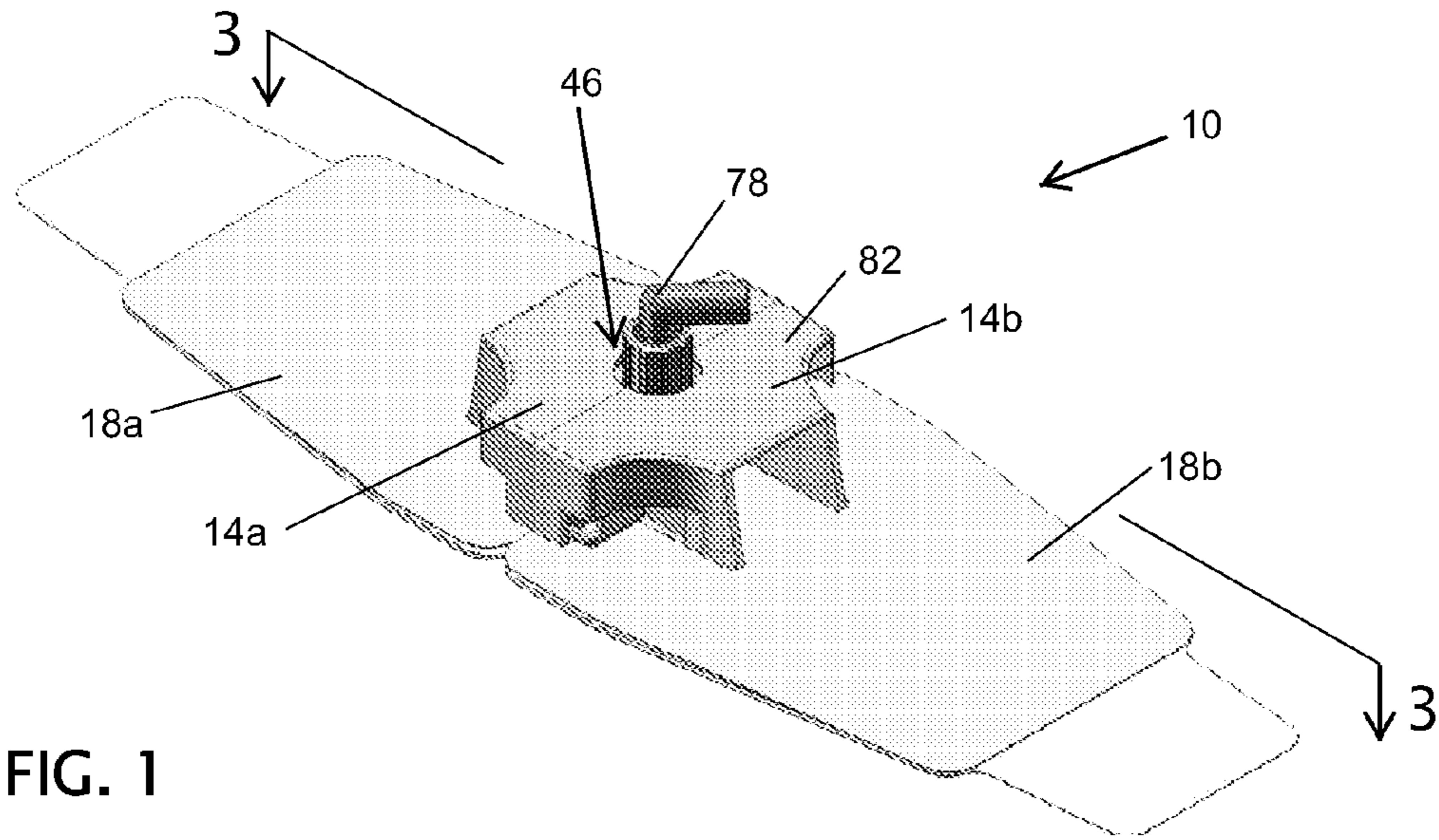


FIG. 1

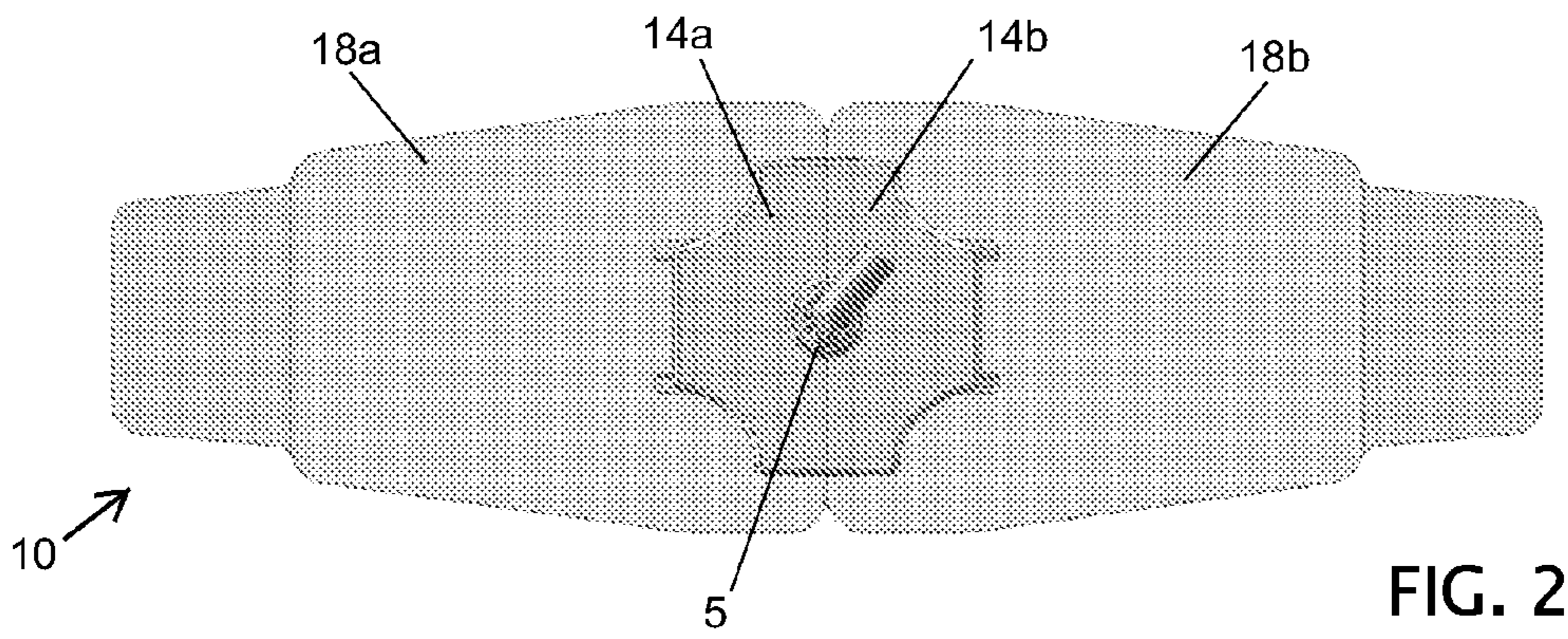


FIG. 2

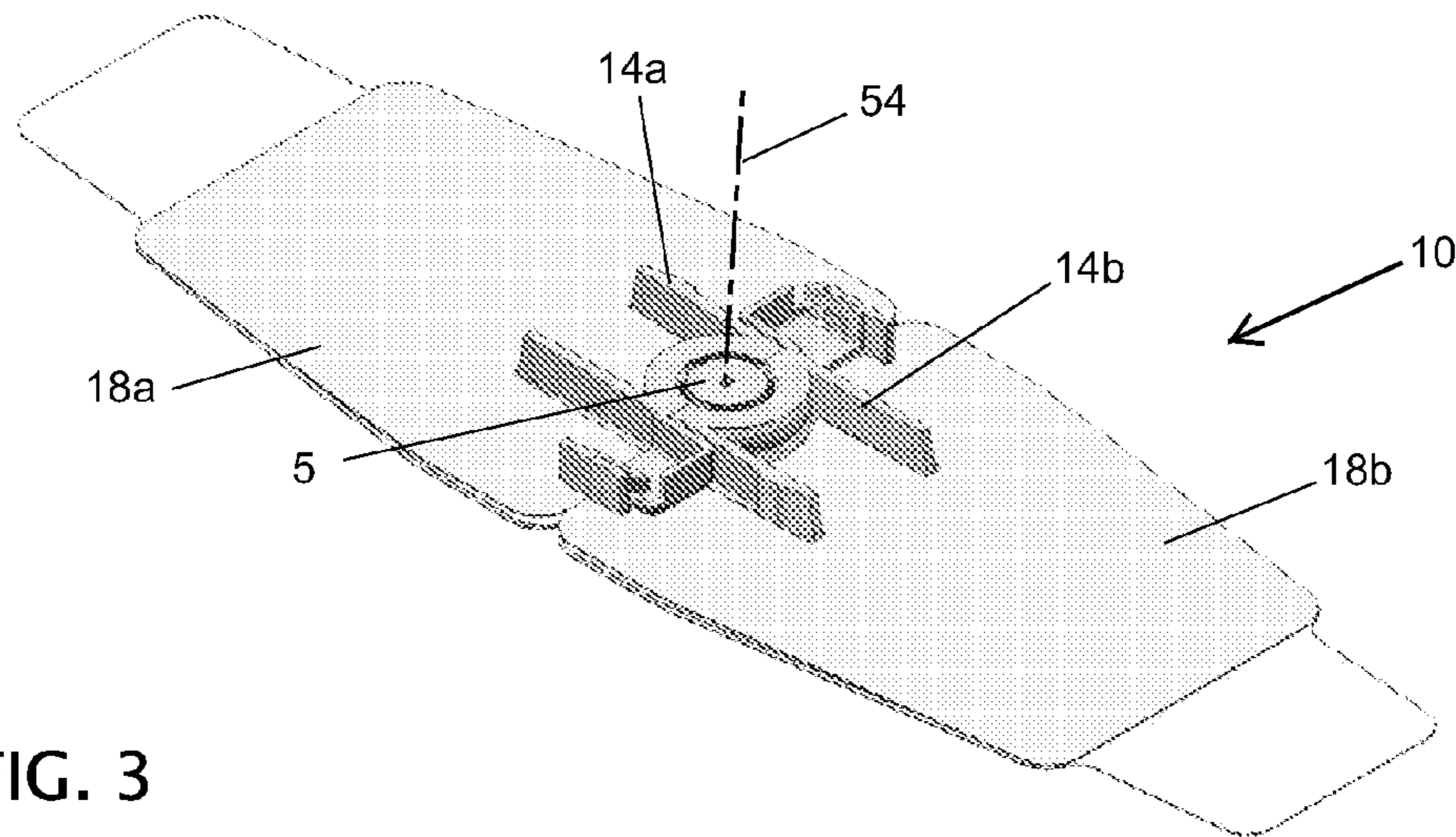


FIG. 3

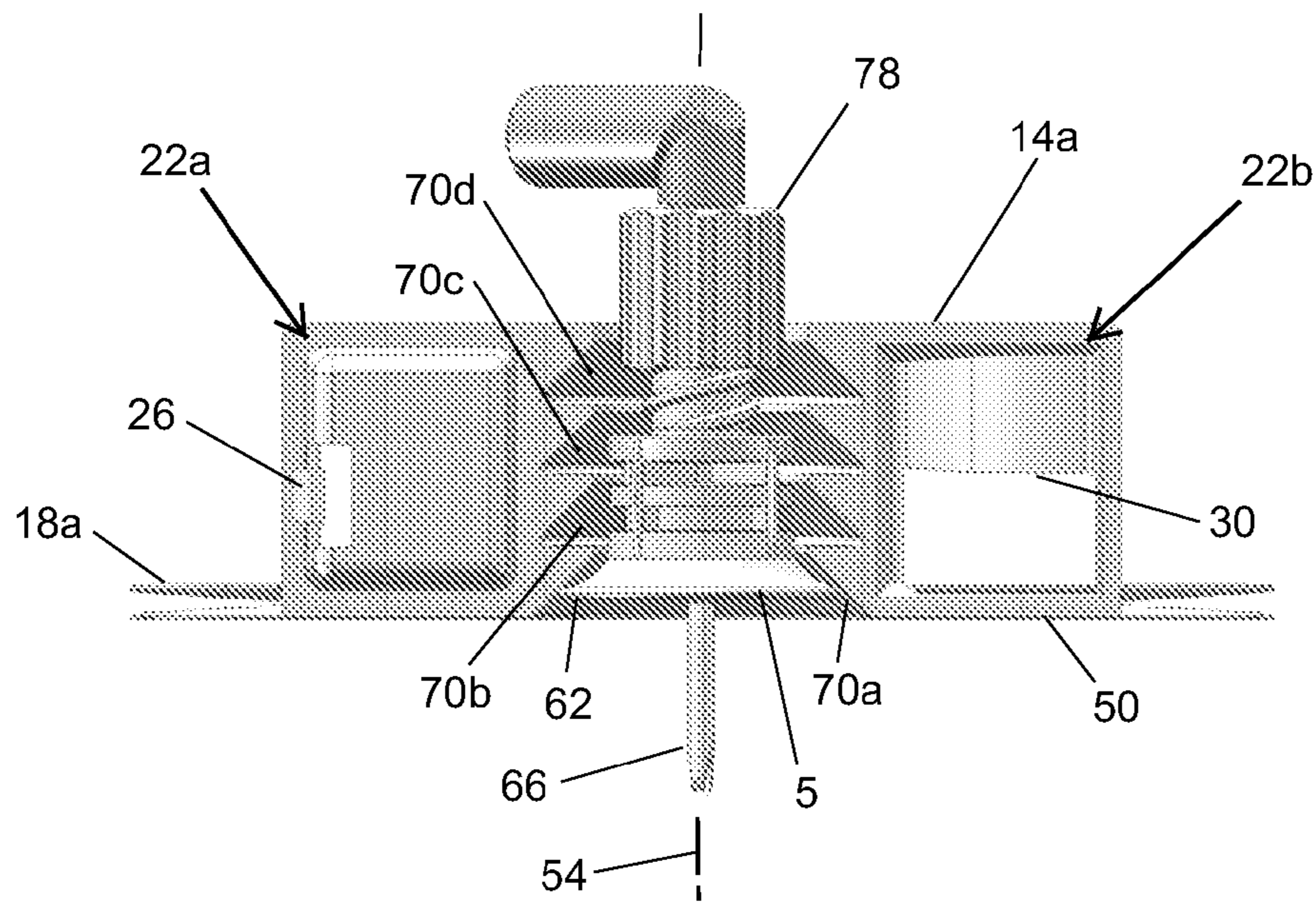


FIG. 4

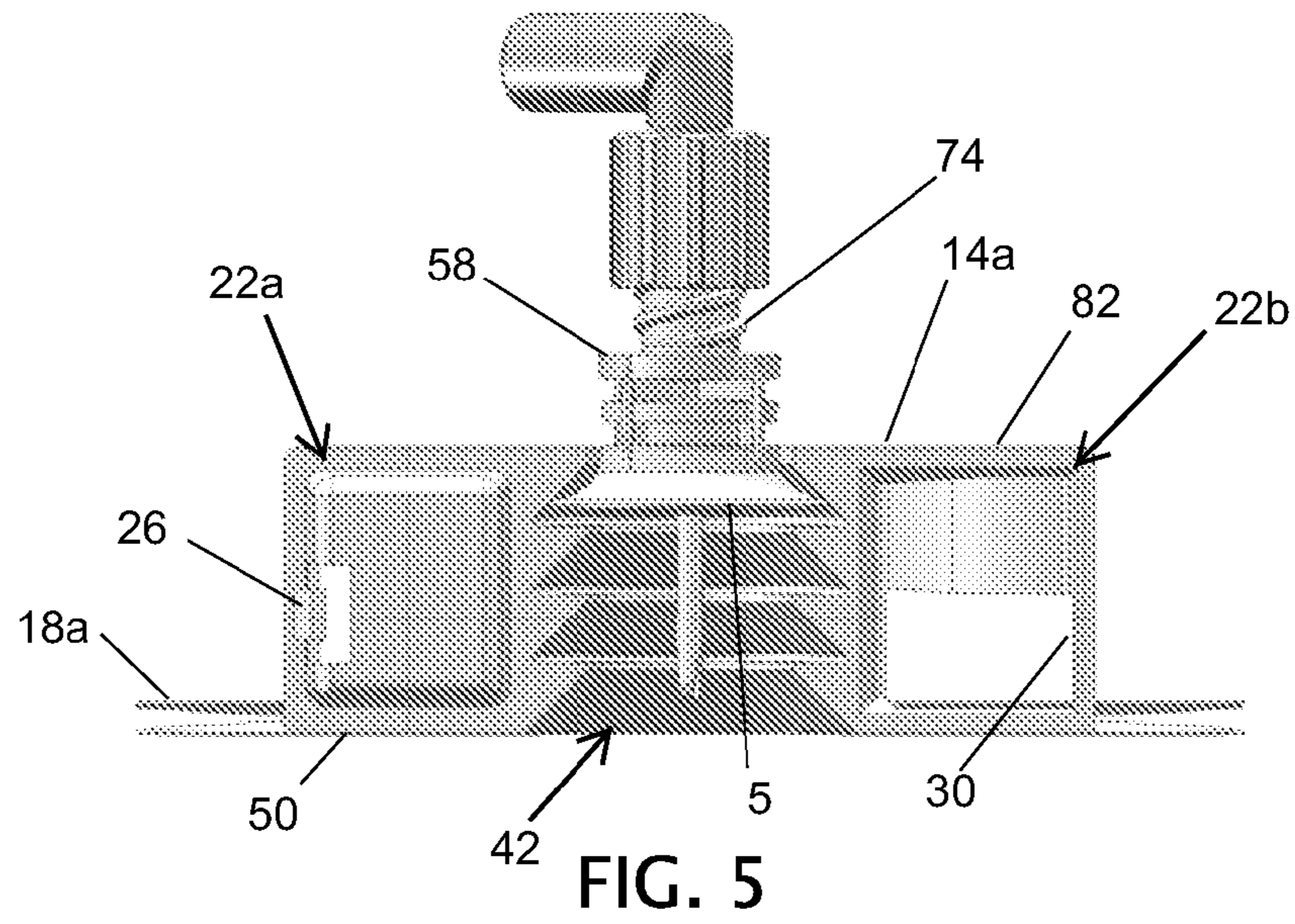


FIG. 5

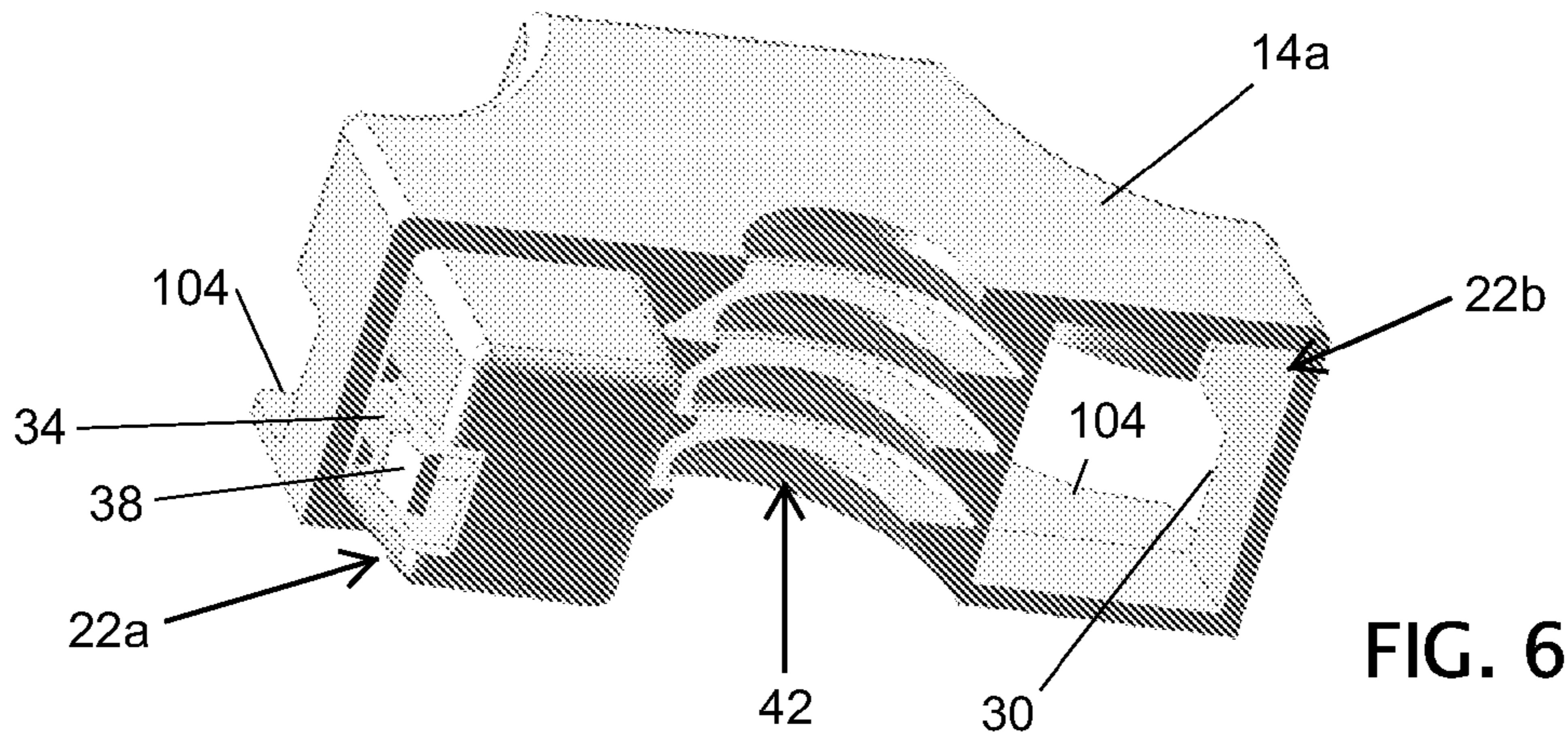


FIG. 6

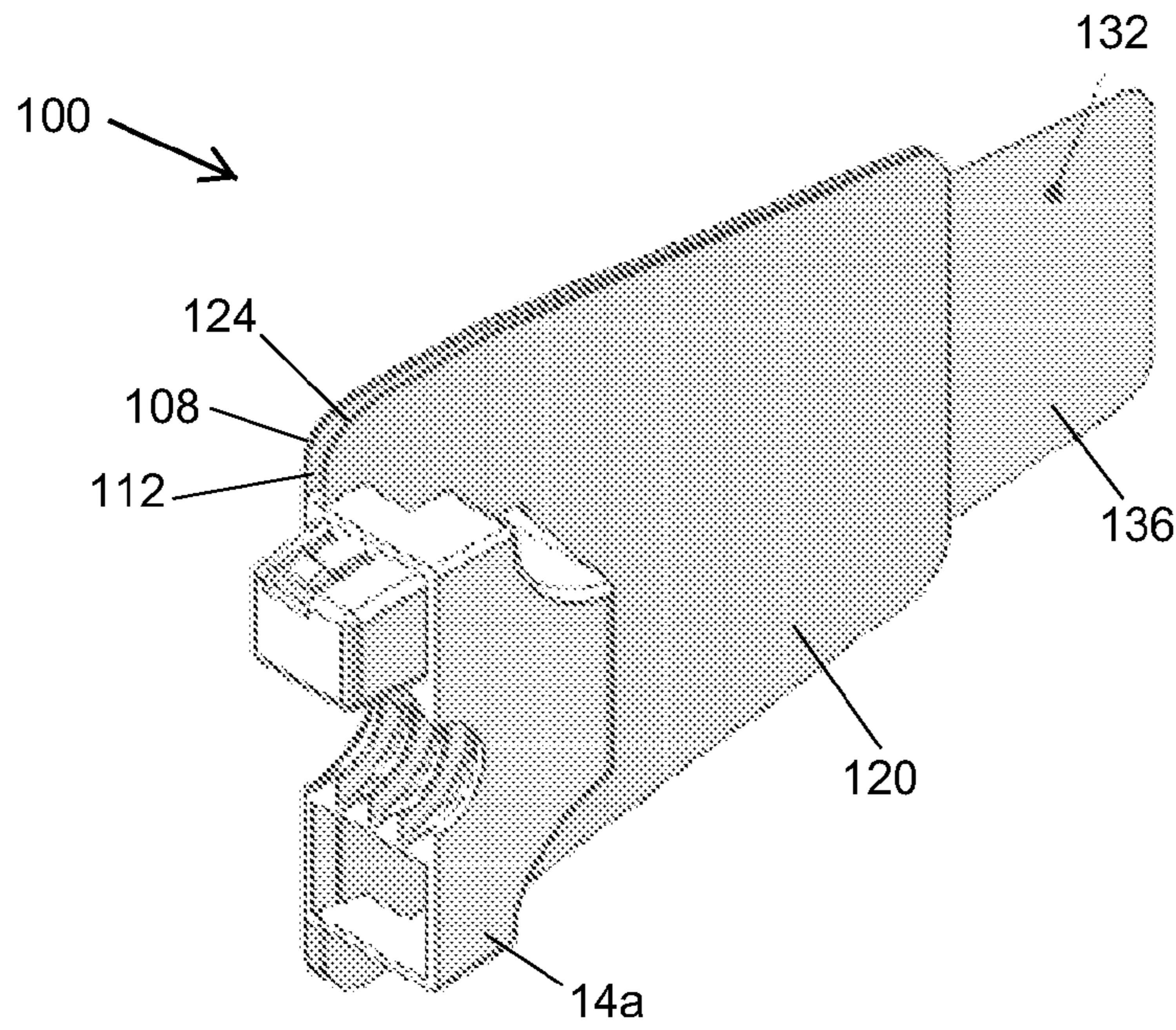


FIG. 7A

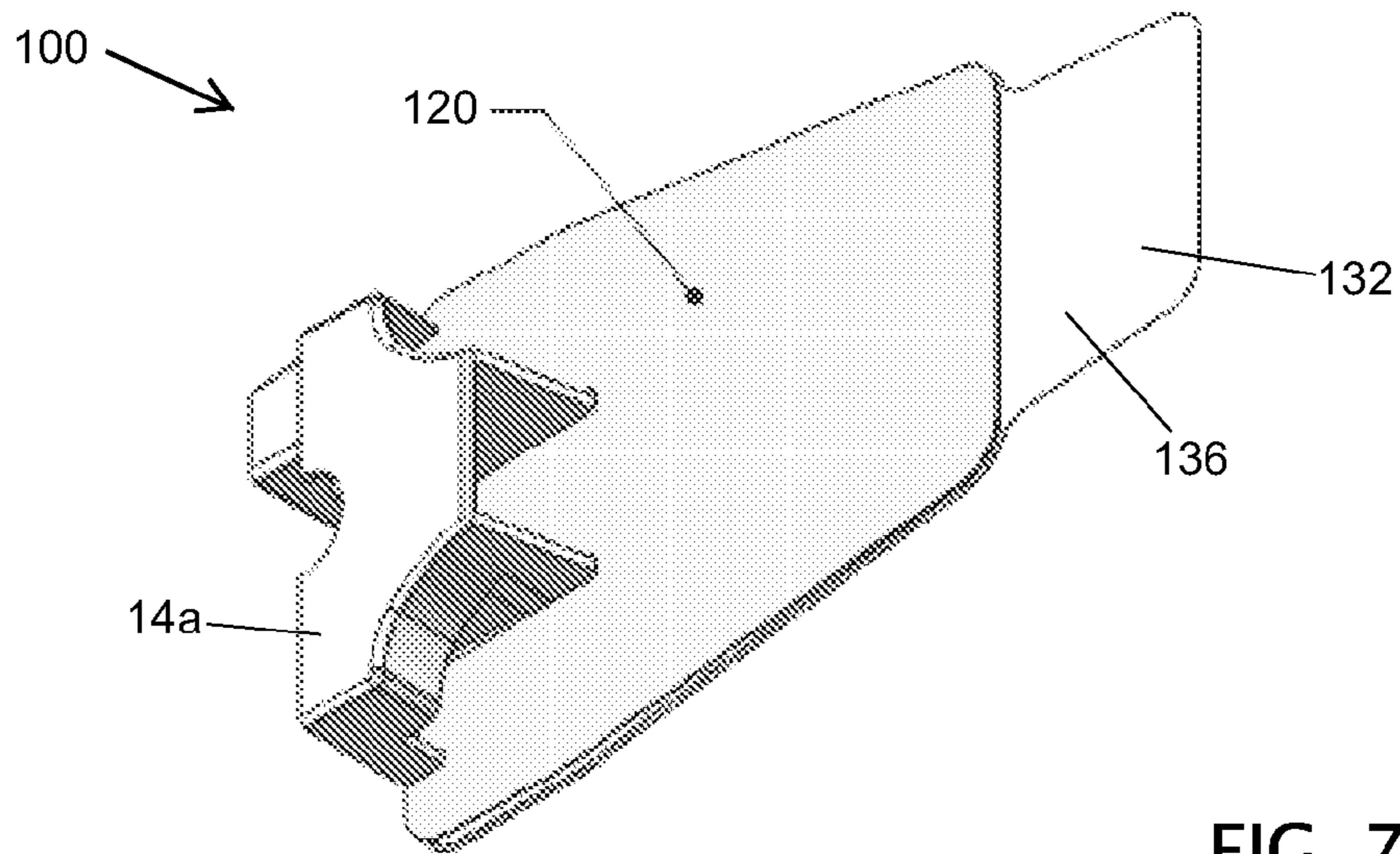


FIG. 7B

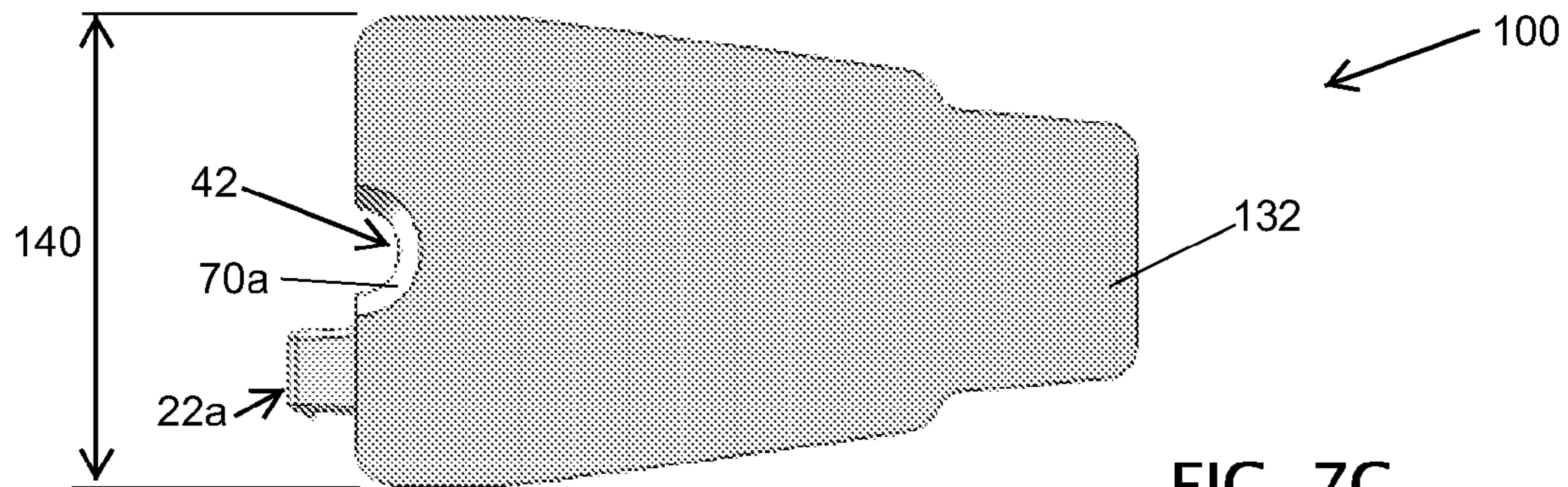
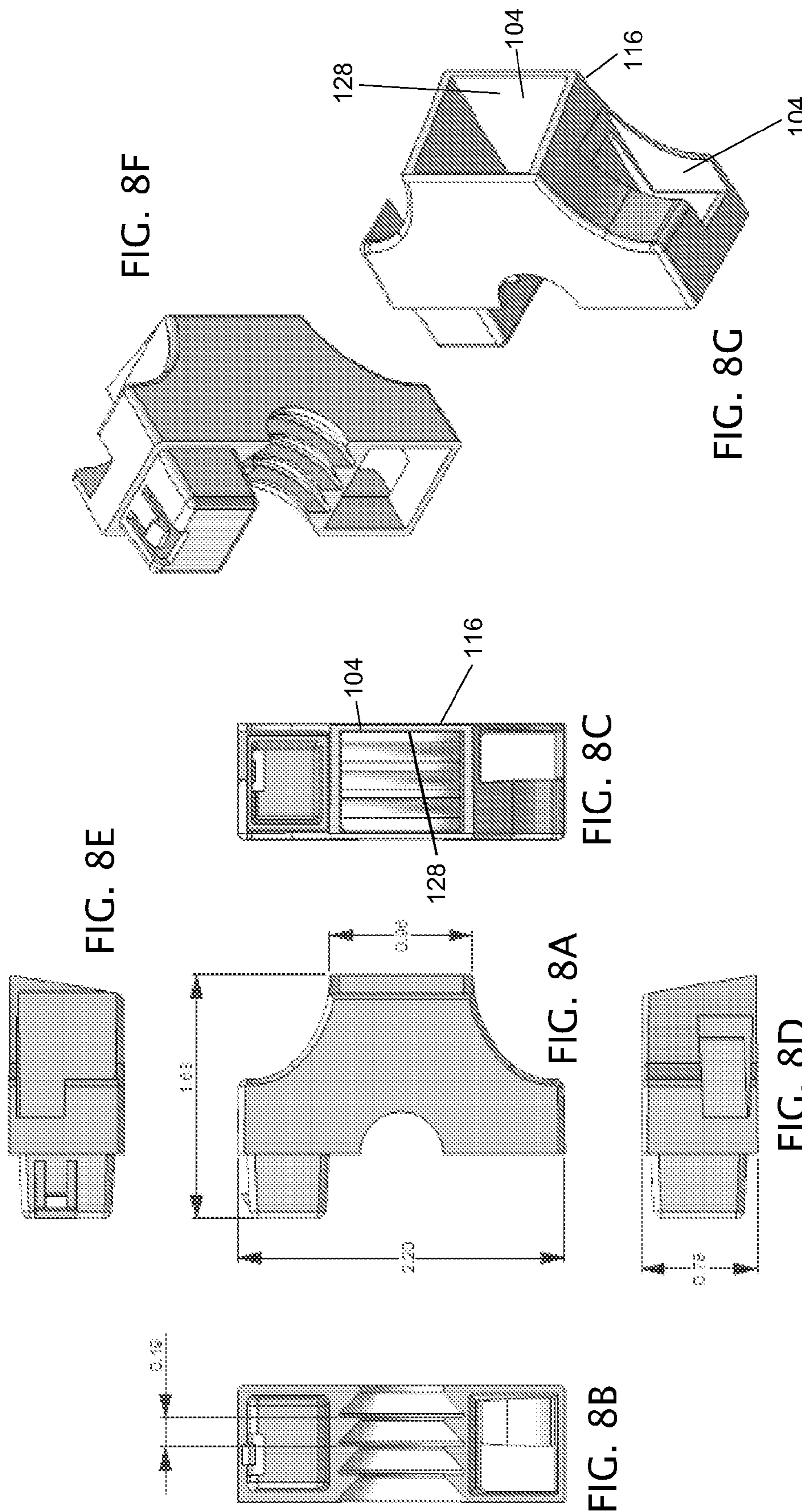


FIG. 7C



## INTRAOSSIOUS-NEEDLE STABILIZER AND METHODS

### CROSS-REFERENCE TO RELATED APPLICATION

This application is a national phase application under 35 U.S.C. §371 of International Application No. PCT/US2011/023496, filed Feb. 2, 2011, which claims priority to U.S. Provisional Patent Application No. 61/184,035, filed Feb. 2, 2010. The entire text of each of the above-referenced applications is specifically incorporated by reference without disclaimer.

### BACKGROUND

#### 1. Field of the Invention

The present invention relates generally to accessing intraosseous blood vessels and, more particularly, but not by way of limitation, to stabilizers for intraosseous devices.

#### 2. Description of Related Art

Intraosseous devices and support devices are known in the art. One example of an intraosseous device (including a needle) and support device is disclosed in U.S. patent application Ser. No. 11/619,390, filed Jan. 3, 2007, and published as Patent Pub. No. US 2008/0140014; which is incorporated by reference in its entirety.

### SUMMARY

Some embodiments of the present apparatuses comprise: two members configured to be coupled together such that the members cooperate to encircle an intraosseous device to resist movement of the intraosseous device relative to the members; and one or more flexible tabs each coupled to at least one of the members and comprising an adhesive layer configured to be coupled to skin of a patient. In some embodiments, the apparatus is non-sterile. In some embodiments, the two members are substantially identical.

In some embodiments, the two members each comprise two connection portions. In some embodiments, the two connection portions comprise a male connection portion and a female connection portion. In some embodiments, the male connection portion comprises a resilient barb, and the female connection portion comprises a ledge configured such that if the members are coupled together, the resilient barb of each member contacts the ledge of the other member to resist separation of the members.

In some embodiments, the two members each comprise a coupling surface between the two connection portions, the coupling surface configured such that if the two members are coupled together, the coupling surfaces cooperate to define a device opening in which a portion of an intraosseous device can be positioned. In some embodiments, the members each have a proximal surface configured to face the patient's skin, and if the members are coupled together a longitudinal axis of the device opening is disposed at a non-zero angle relative to a plane of the proximal surface. In some embodiments, the longitudinal axis of the device opening is substantially perpendicular to a plane of the proximal surface. In some embodiments, the coupling surface of each member defines a groove configured to receive a flange of an intraosseous device. In some embodiments, the coupling surface of each member defines a plurality of grooves each configured to receive a flange of an intraosseous device in a different position of the intraosseous device relative to the proximal surface of the member. In some

embodiments, the plurality of grooves in the coupling surface are each shaped to correspond to a portion of an intraosseous device.

In some embodiments, each member comprises a lower sidewall, and one of the one or more flexible tabs is coupled to the lower sidewall. In some embodiments, the one or more flexible tabs each comprises: a double-sided tape layer having an upper side coupled to a lower surface of the lower sidewall; and a single-sided tape layer having an adhesive side coupled to an upper surface of the lower sidewall and to a portion of the upper side of the double-sided tape layer that is not coupled to the lower surface of the lower sidewall. In some embodiments, the one or more flexible tabs each comprises: a liner layer coupled to a lower side of the double-sided tape layer; where the liner layer is configured to be removable from the lower side of the double-sided tape layer such that the lower side of the double-sided tape layer can be coupled to skin of a patient. In some embodiments, the liner layer extends beyond at least one peripheral edge of the double-sided tape layer. In some embodiments, when the members are coupled together around the hub of an intraosseous device, and the tabs are coupled to skin, the apparatus may keep the intraosseous device to which it has been coupled (and, particularly, the hub of the device and any fitting and associated tubing connected to it) in a stable position relative to the patient by, for example, resisting movement of the device and any associated connector relative to the patient.

In some embodiments, at least one lateral dimension of at least one of the flexible tabs, when flattened, does not exceed 4 inches. In some embodiments, at least one lateral dimension of at least one of the flexible tabs, when flattened, does not exceed 3.1 inches. In some embodiments, if the members are coupled together, the members fit within a rectangular volume no greater than 6 inches cubed. In some embodiments, if the members are coupled together, the members fit within a rectangular volume no greater than 4 inches cubed.

Some embodiments of the present kits comprise: three or more members each configured to be coupled to any of the other plurality of members such that the coupled members cooperate to encircle an intraosseous device to resist movement of the intraosseous device relative to the members; and a plurality of flexible tabs each coupled to at least one of the members and comprising an adhesive layer configured to be coupled to skin of a patient. In some embodiments, at least one of the three or members comprises one or more of the features of a member of the present apparatuses.

Some embodiments of the present components comprise: a member; and a flexible tab coupled to the member and comprising an adhesive layer configured to be coupled to skin of a patient; where the member is configured to be coupled a substantially identical member such that the coupled members cooperate to encircle an intraosseous device to resist movement of the intraosseous device relative to the members. In some embodiments, the apparatus is non-sterile. the member comprises one or more features of a member of the present apparatuses.

Some embodiments of the present methods comprise: coupling any embodiment of the present apparatuses to an intraosseous device having a portion extending into a bone of a patient; and coupling the adhesive layer of at least one of the one or more flexible tabs to the patient such that the apparatus resists motion of the members relative to the skin to which the adhesive layer is coupled. In some embodiments, the apparatus is non-sterile. In some embodiments,



coupling the apparatus to the intraosseous device is performed while the intraosseous device is coupled to a fluid source.

Some embodiments of the present apparatuses comprise: coupling a support apparatus to an intraosseous device having a portion extending into a bone of patient while the intraosseous device is coupled to a fluid source; and coupling the support apparatus to the skin of patient such that the support apparatus resists displacement of the intraosseous device relative to the skin to which the support apparatus is coupled.

In any embodiment of the present disclosure, the term “substantially” may be substituted with “within [a percentage] of” what is specified, where the percentage includes 5, 10, and/or 15 percent.

Any embodiment of any of the present devices and kits can consist of or consist essentially of—rather than comprise/include/contain/have—any of the described steps, elements, and/or features. Thus, in any of the claims, the term “consisting of” or “consisting essentially of” can be substituted for any of the open-ended linking verbs recited above, in order to change the scope of a given claim from what it would otherwise be using the open-ended linking verb.

Details associated with the embodiments described above and others are presented below.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The following drawings illustrate by way of example and not limitation. For the sake of brevity and clarity, every feature of a given structure is not always labeled in every figure in which that structure appears. Identical reference numbers do not necessarily indicate an identical structure. Rather, the same reference number may be used to indicate a similar feature or a feature with similar functionality, as may non-identical reference numbers. The figures are drawn to scale (unless otherwise noted), meaning the sizes of the depicted elements are accurate relative to each other for at least the embodiment depicted in the figures.

FIG. 1 depicts a perspective view of one embodiment of the present stabilizers which includes two stabilizer members and two flexible tabs.

FIG. 2 depicts a top view of the stabilizer of FIG. 1.

FIG. 3 depicts a perspective cross-sectional view of the stabilizer of FIG. 1 taken along the line 3-3 of FIG. 1.

FIG. 4 depicts a side view of a member of the stabilizer of FIG. 1 shown with an intraosseous device in a first position relative to the stabilizer.

FIG. 5 depicts a side view of a member of the stabilizer of FIG. 1 shown with an intraosseous device in a second position relative to the stabilizer.

FIG. 6 depicts a perspective view of a member of the stabilizer of FIG. 1.

FIGS. 7A-7C depicts various views of a member and a flexible tab of the stabilizer of FIG. 1.

FIGS. 8A-8G depicts various views of the member of FIG. 6.

#### DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

The term “coupled” is defined as connected, although not necessarily directly, and not necessarily mechanically; two items that are “coupled” may be unitary with each other. The terms “a” and “an” are defined as one or more unless this disclosure explicitly requires otherwise. The term “substantially” is defined as largely but not necessarily wholly what

is specified (and includes what is specified; e.g., substantially 90 degrees includes 90 degrees and substantially parallel includes parallel), as understood by a person of ordinary skill in the art.

The terms “comprise” (and any form of comprise, e.g., “comprises” and “comprising”), “have” (and any form of have, e.g., “has” and “having”), “include” (and any form of include, e.g., “includes” and “including”) and “contain” (and any form of contain, e.g., “contains” and “containing”) are open-ended linking verbs. As a result, a device or kit that “comprises,” “has,” “includes” or “contains” one or more elements possesses those one or more elements, but is not limited to possessing only those elements. Likewise, a method that “comprises,” “has,” “includes” or “contains” one or more steps possesses those one or more steps, but is not limited to possessing only those one or more steps.

Further, a device or structure that is configured in a certain way is configured in at least that way, but it can also be configured in other ways than those specifically described. As used in this disclosure, a part or component that is unitary with another part or component means that the parts are of a physically continuous piece of material (e.g., are not physically separate from one another). For example, two of the present members may be of unitary construction if molded or otherwise formed as a single piece of material (e.g., with a flexible piece of material joining the two members in such a way that their connection portions may fixedly couple the two members together, as described in more detail below, and that also maintains a flexible connection between the two members if their connection portions are not coupled together).

Some embodiments of the present stabilizers are configured to couple an intraosseous (sometimes referred to as an interosseous) device to various bones and/or through various sites on a patient (e.g., arm, leg, sternum, shoulder). Examples of such intraosseous devices include the EZ-IO line of products offered by Vidacare Corporation, San Antonio, Tex., USA; and may include a hub with a cannula and/or an intraosseous needle (the intraosseous needle may be removable after insertion of the device such that a portion of the device extends into a bone of a patient).

Referring now to the drawings, and more particularly to FIGS. 1-5, shown therein and designated by the reference numeral 10 is an embodiment of the present stabilizers. FIG. 1 depicts a perspective view of stabilizers 10 that includes two stabilizer members 14a, 14b, and two flexible tabs 18a, 18b. FIG. 2 depicts a top view of stabilizer 10. FIG. 3 depicts a perspective cross-sectional view of stabilizer 10 taken along the line 3-3 of FIG. 1. FIG. 4 depicts a side view of member 14a of stabilizer 10 shown with an intraosseous device 5 in a first position relative to the stabilizer. FIG. 5 depicts a side view of member 14a of stabilizer 10 shown with intraosseous device 5 in a second position relative to the stabilizer.

In the embodiment shown, members 14a and 14b are configured to be coupled together (and are shown coupled together) such that members 14a and 14b cooperate to encircle intraosseous device 5 (e.g., such that neither member individually encircles device 5) to resist movement of intraosseous device 5 relative to members 14a and 14b. In some embodiments, stabilizer 10 comprises one or more flexible tabs (18a, 18b) each coupled to at least one of the members (14a, 14b) and comprising an adhesive layer (not shown) configured to be coupled to skin of a patient. For example, in the embodiment shown, stabilizer 10 comprises two flexible tabs 18a and 18b each coupled to a different one of members 14a and 14b, respectively. Once the flexible tabs

have been coupled to skin, the stabilizer is designed to keep the intraosseous device to which it has been coupled (and, particularly, the hub of the device and any fitting and associated tubing connected to it) in a stable position relative to the patient, which may entail resisting movement of the device and any associated connector relative to the patient.

In some embodiments, members **14a**, **14b** are resilient and/or at least partially rigid. For example, members **14a**, **14b** may each have a portion (e.g., a portion configured to contact device **5**) that is substantially rigid, and another portion configured to resiliently flex (e.g., be deflectable to be coupled to the other members, as described in more detail below). Members **14a** and **14b** may comprise any suitable material, such as, for example, plastic(s), metal(s), alloy(s), composite(s), or the like, that permits the members to function as described in this disclosure. In other embodiments, members **14a** and **14b** may have any suitable outer shape, such as, for example, arcuate, curved, square, and/or may be expanded or indented in some portions to improve a user's ability to grip the member and/or the stabilizer.

In the embodiment shown, members **14a** and **14b** are substantially identical. As such, only a single member **14a** is shown in each of FIGS. **4** and **5**. FIG. **6** depicts a perspective view of member **14a** without tab **18a**. In other embodiments, members **14a** and **14b** may differ (e.g., may have different connection portions, shapes, and/or the like). In the embodiment shown, member **14a** comprises two connection portions **22a** and **22b**. In the embodiment shown, connection portion **22a** is configured as a male connection portion, and connection portion **22b** is configured as a female connection portion. Stated another way, in the embodiment shown, male connection portion **22a** is configured to be inserted into a corresponding female connection portion **22b** of another member (e.g., **14b**), and female connection portion **22b** is configured to receive a corresponding male connection portion **22a** of another member (e.g., **14b**).

In the embodiment shown, male connection portion **22a** comprises a resilient barb **26**, and the female connection portion comprises a ledge **30** configured such that if members **14a** and **14b** are coupled together (e.g., with male connection portion **22a** of member **14a** extending female connection portion **22b** of member **14b**, and with male connection portion **22a** of member **14b** extending into female connection portion **22b** of member **14a**), the resilient barb (**26**) of each member (**14a** or **14b**) contacts the ledge (**30**) of the other member (**14b** or **14a**) to resist separation of the members (**14a** and **14b**). In the embodiment shown, barb **26** comprises an arm **34** configured to flex (be deflectable) relative to the rest of member **14a**, and a projection **38** (e.g., a tapered projection), such that as members **14a** and **14b** are pressed together to be coupled, arm **34** of member **14a** flexes inward (toward female connection member **22b** of member **14a**) until projection **38** moves past ledge **30** of member **14b**, at which point arm **34** flexes outward such that projection **38** extends past ledge **30** and thereby mechanically resists separation of members **14a** and **14b**. In other embodiments, connection portions **22a** and **22b** can have any functional configuration, such as, for example: both connection portions **22a** and **22b** of member **14a** may be configured as male connection portions, and both connection portions **22a** and **22b** of member **14b** may be configured as female connection portions; each of connection portions **22a** and **22b** may comprise a male component and a female component; each of connection portions **22a** and **22b** can comprise a serrated or saw-tooth configuration; and/or the like.

In the embodiment shown, member **14a** comprises a coupling surface **42** between connection portions **22a** and

**22b**, and coupling surface **42** is configured such that if the two members are coupled together, the coupling surfaces cooperate to define a device opening **46** in which a portion of an intraosseous device can be positioned (e.g., as shown in FIGS. **1-3**). In the embodiment shown, member **14a** has a proximal surface **50** (e.g., at or near the plane of tab **18a** shown in FIGS. **5-6**) configured to face the patient's skin. In the embodiment shown, members **14a** and **14b** are configured such that if members **14a** and **14b** are coupled together a longitudinal axis **54** of device opening **46** is disposed at a non-zero angle (e.g., 90 degrees) relative to a plane of proximal surface **50**.

In the embodiment shown, device **5** comprises a hub **58**, a flange **62**, and a cannula **66** (e.g., a needle may extend through cannula **66** during insertion of cannula into a patient's bone). In some embodiments, coupling surface **42** defines at least one groove **70** configured to receive a flange (e.g., **62**) of an intraosseous device. For example, in the embodiment shown, coupling surface **42** defines a plurality of grooves **70a**, **70b**, **70c**, **70d** each configured to receive a flange (e.g., **62**) of an intraosseous device in a different position of the intraosseous device relative to proximal surface **50** of the member (e.g., if flange **62** is received in groove **70a** then flange may be adjacent the patient's skin (or the position the patient's skin would be absent an injury); and if flange **62** is received in any of grooves **70b**, **70c**, **70d** then flange **62** may be spaced apart from a patient's skin at a position predetermined by the position of the groove in which the flange is received. In the embodiment shown, grooves **70a**, **70b**, **70c**, **70d** are shaped to correspond to a portion of an intraosseous device (e.g., as shown, grooves **70a**, **70b**, **70c**, **70d** are tapered between a relatively larger proximal end closest proximal surface **50** and a relatively smaller distal end that is farther from proximal surface **50**).

As shown, intraosseous device **5** may comprise a fitting **74** (e.g., a Luer lock fitting, or the like) to which a fluid source **78** (a structure from or through which fluid may be delivered to device **5**, such as, for example, a tube couplable to an IV bag, and IV bag, a syringe, and/or the like). In the embodiment shown, member **14** has a height or thickness between proximal surface **50** and a distal surface **82** that permits fitting **74** to extend above distal surface **82** to be accessible while stabilizer **10** is coupled to device **5** and/or permits stabilizer **10** to be coupled to device **5** while a fluid source **78** is coupled to device **5**. In some embodiments, stabilizer **10** is non-sterile (is not sterile).

FIGS. **7A-7C** depicts various views of member **14a** and flexible tab **18a** coupled to member **14a** (which may together be referred to as a component **100** of stabilizer **10**). In the embodiment shown tab **18a** is substantially identical to tab **18b**. In the embodiment shown, member **14a** is configured to be coupled a substantially identical member (e.g., **14b**) such that the coupled members (**14a** and **14b**) cooperate to encircle an intraosseous device (e.g., **5**) to resist movement of the intraosseous device relative to the members. In some embodiments, member **14a** comprises a lower sidewall **104**, and one of the one or more flexible tabs (**18a**) is coupled to lower sidewall **104**. For example, in the embodiment shown, tab **18a** comprises: a double-sided tape layer **108** having an upper side **112** coupled to a lower surface **116** of lower sidewall **104**; and a single-sided tape layer **120** having an adhesive lower side **124** (facing double-sided tape layer **108**) coupled to an upper surface **128** of lower sidewall **104** and to a portion of upper side **112** of double-sided tape layer **108** that is not coupled to lower surface **116** of lower sidewall **104**. In the embodiment shown, tab **18a** also comprises: a liner layer **132** coupled to

a lower side (not shown, but facing liner layer 132) of double-sided tape layer 108; and liner layer 132 is configured to be removable from the lower side of double-sided tape layer 108 such that the lower side of the double-sided tape layer can be coupled to skin of a patient. In the embodiment shown, liner layer 132 includes a tab portion 136 that extends beyond at least one peripheral edge of double-sided tape layer 108.

In some embodiments, at least one lateral dimension (e.g., 140 shown in FIG. 7C) of at least one of the flexible tabs (e.g., 18a), when flattened (not wrinkled, as shown in FIG. 7C), does not exceed 4 inches. For example, in the embodiment shown, lateral dimension 140, when tab 18a is flattened, does not exceed 3.1 inches.

FIGS. 8A-8G depict various views of member 14a that may assist in fully understanding the features of member 14a. In particular, FIG. 8A depicts a top view of member 14a; FIGS. 8B-8C depict front and back side views of member 14a; FIGS. 8D-8F depict left and right side views of member 14a; and FIGS. 8F-8G depicts upper perspective views of member 14a. In the embodiment shown, member 14a is configured such that if two members (e.g., 14a, 14b) are coupled together (as shown in FIGS. 1-2), the two coupled members fit within a rectangular volume no greater than 6 inches cubed. For example, in the embodiment shown, member 14a is configured such that if two members (e.g., 14a, 14b) are coupled together, the two coupled members fit within a rectangular volume no greater than 4 inches cubed. The dimensions shown in FIGS. 8A-8G are accurate for at least one embodiment of members 14a.

Some embodiments of the present kits comprise: three or more of the present members (e.g., 14a) each configured to be coupled to any of the other plurality of members such that the coupled members cooperate to encircle an intraosseous device to resist movement of the intraosseous device relative to the members (e.g., as shown in FIGS. 1-2); and a plurality of flexible tabs (e.g., 18a) each coupled to at least one of the members and comprising an adhesive layer configured to be coupled to skin of a patient.

Some embodiments of the present methods comprise: coupling one of the present apparatuses (e.g., stabilizer 10) to an intraosseous device (e.g., 5) having a portion (e.g., the cannula) extending into a bone of a patient; and coupling the adhesive layer (e.g., bottom side of double-sided tape layer 108) of at least one of the one or more flexible tabs (e.g., 18a) to the patient such that the apparatus (stabilizer) resists motion of the members (e.g., 14a, 14b) relative to the skin to which the adhesive layer (e.g., 108) is coupled. In some embodiments, coupling the apparatus to the intraosseous device is performed while the intraosseous device is coupled to a fluid source (e.g., 78).

Some embodiments of the present methods comprise: coupling a support apparatus (e.g., stabilizer 10) to an intraosseous device (e.g., 5) having a portion (e.g., cannula 66) extending into a bone of patient while the intraosseous device is coupled to a fluid source (e.g., 78); and coupling the support apparatus (e.g., 10) to the skin of patient such that the support apparatus resists displacement of the intraosseous device (e.g., 5) relative to the skin to which the support apparatus is coupled.

The various illustrative embodiments of the present devices and kits are not intended to be limited to the particular forms disclosed. Rather, they include all modifications, equivalents, and alternatives falling within the scope of the claims.

The claims are not intended to include, and should not be interpreted to include, means-plus- or step-plus-function

limitations, unless such a limitation is explicitly recited in a given claim using the phrase(s) "means for" or "step for," respectively.

The invention claimed is:

1. An apparatus comprising:

two members configured to be coupled together such that the two members cooperate to encircle an intraosseous device to resist movement of the intraosseous device relative to the members, where the two members when coupled together cooperate to define an opening for the intraosseous device, where the two members define opposite sides of the opening; and

one or more flexible tabs each coupled to at least one of the members and comprising an adhesive layer configured to be coupled to skin of a patient,

where the members each have a proximal surface configured to face the skin of the patient, where a longitudinal axis of the opening is disposed at a non-zero angle relative to a plane of the proximal surface,

where the members each have a coupling surface, each coupling surface defining a first groove configured to receive a portion of the intraosseous device when the intraosseous device is in a first position in the opening relative to the proximal surface of at least one of the two members and a second groove configured to receive the portion of the intraosseous device when the intraosseous device is in a second position in the opening relative to the proximal surface of at least one of the two members, the first position closer to the proximal surface of at least one of the two members than the second position.

2. The apparatus of claim 1, where the two members are substantially identical.

3. The apparatus of claim 1, where the two members each comprise two connection portions.

4. The apparatus of claim 3, where the two connection portions comprise a male connection portion and a female connection portion.

5. The apparatus of claim 4, where the male connection portion comprises a resilient barb, and the female connection portion comprises a ledge configured such that if the members are coupled together, the resilient barb of each member contacts the ledge of the other member to resist separation of the members.

6. The apparatus of claim 1, where the coupling surface of each member is configured such that when the two members are coupled together, the coupling surfaces cooperate to define the opening.

7. The apparatus of claim 6, where the first and second grooves are configured to receive a flange of the intraosseous device.

8. The apparatus of claim 1, where the longitudinal axis of the device opening is substantially perpendicular to a plane of the proximal surface.

9. The apparatus of claim 1, where the first and second grooves in the coupling surface are each shaped to correspond to the portion of the intraosseous device.

10. The apparatus of claim 1, where each member comprises a lower sidewall, and one of the one or more flexible tabs is coupled to the lower sidewall.

11. The apparatus of claim 10, where the one or more flexible tabs each comprises:

a double-sided tape layer having an upper side coupled to a lower surface of the lower sidewall; and

a single-sided tape layer having an adhesive side coupled to an upper surface of the lower sidewall and to a

9

portion of the upper side of the double-sided tape layer that is not coupled to the lower surface of the lower sidewall.

**12.** The apparatus of claim **11**, where the one or more flexible tabs each comprises:

a liner layer coupled to a lower side of the double-sided tape layer;

where the liner layer is configured to be removable from the lower side of the double-sided tape layer such that the lower side of the double-sided tape layer can be coupled to skin of a patient.

**13.** The apparatus of claim **12**, where the liner layer extends beyond at least one peripheral edge of the double-sided tape layer.

**14.** The apparatus of claim **1**, where the apparatus is non-sterile.

**15.** The apparatus of claim **1**, where the two members are configured to be coupled together to encircle the intraosseous device after the intraosseous device is inserted into a bone.

**16.** The apparatus of claim **1**, where the first groove comprises a shape identical to a shape of the second groove.

**17.** The apparatus of claim **16**, where the first and second grooves each comprise a tapered surface.

**18.** A kit comprising:

three or more members each configured to be coupled to any of the other plurality of members such that the coupled members cooperate to encircle an intraosseous device to resist movement of the intraosseous device relative to the members, where the coupled members cooperate to define an opening for the intraosseous device, where the coupled members define opposite sides of the opening; and

a plurality of flexible tabs each coupled to at least one of the members and comprising an adhesive layer configured to be coupled to skin of a patient,

where the three or more members each have a proximal surface configured to face the skin of the patient, where a longitudinal axis of the opening is disposed at a non-zero angle relative to a plane of the proximal surface,

where the three or more members each have a coupling surface, each coupling surface defining a first groove configured to receive a portion of the intraosseous device when the intraosseous device is in a first position in the opening relative to the proximal surface of at least one of the three or more members and a second groove configured to receive the portion of the

10

intraosseous device when the intraosseous device is in a second position in the opening relative to the proximal surface of at least one of the three or more members, the first position closer to the proximal surface of at least one of the three or more members than the second position.

**19.** The kit of claim **18**, where each member comprises two connection portions.

**20.** The kit of claim **18**, where the three or more members are configured to be coupled to any of the other plurality of members to encircle the intraosseous device after the intraosseous device is inserted into a bone.

**21.** A component comprising:

a member; and

a flexible tab coupled to the member and comprising an adhesive layer configured to be coupled to skin of a patient;

where the member is configured to be coupled to a substantially identical member such that the coupled members cooperate to encircle an intraosseous device to resist movement of the intraosseous device relative to the members,

where the coupled members cooperate to define an opening for the intraosseous device, where the coupled members define opposite sides of the opening,

where the member and the substantially identical member each have a proximal surface configured to face the skin of the patient, where a longitudinal axis of the opening is disposed at a non-zero angle relative to a plane of the proximal surface,

where the member and the substantially identical member each have a coupling surface, each coupling surface defining a first groove configured to receive a portion of the intraosseous device when the intraosseous device is in a first position in the opening relative to the proximal surface of at least one of the member and the substantially identical member and a second groove configured to receive the portion of the intraosseous device when the intraosseous device is in a second position in the opening relative to the proximal surface of at least one of the member and the substantially identical member, the first position closer to the proximal surface of at least one of the member and the substantially identical member than the second position.

**22.** The component of claim **21**, where the member comprises a male connection portion.

\* \* \* \* \*